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somewhat simpler formula gives a considerably closer representation of the observations from 1862 to 1882. It is, for the meridian of Greenwich,

$$\phi - \phi_0 = -0.''125 \cos [0.^\circ 843\,(t - 2406191)] - 0.''050 \cos (\odot + 10^\circ)$$

in which t is the number of days since the beginning of the Julian Period.

From the smallness of these variations it will be seen that the corrections to the latitude which they give will seldom need to be considered. It is only in the most accurate work that their being neglected will have any appreciable influence. As has been stated above, the problem of the variation of latitude is not yet fully solved. The cause of the annual term is yet unexplained. The question of the secular variation of latitude has been raised, but its existence has not yet been established, and even if it is, it is not likely to have any very sensible influence upon the results, either of the engineer or of the astronomer. From an astronomical point of view, the variation of latitude is important not in itself alone but also on account of the influence it has in vitiating the results of the astronomy of precision. It affects almost all kinds of absolute measurements. Equator point, equinoctical point, obliquity of the ecliptic, constant of aberration, stellar parallaxes, and absolute right ascensions and declinations of stars, may be mentioned as examples. And when the systematic errors introduced by it are eliminated, a conclusion is reached which is most gratifying to astronomers. It is that the degree of precision already attained in astronomical observation is far greater than had hitherto been supposed.

STANFORD UNIVERSITY, CALIFORNIA, April 8, 1893.

THE BRIGHT STREAKS ON THE MOON.

By J. M. SCHAEBERLE.

The remarkable appearance presented by the Moon's surface, more particularly with reference to the great light-reflecting power of certain peculiarly arranged areas, has given rise to various hypotheses concerning the cause of these features.

As a result of certain investigations at present under way, a singularly plausible explanation has forced itself upon my attention. As the matter is intimately connected with some results outlined in a "preliminary note" published in No. 306 of the *Astronomical Journal*, I must refer the reader to that journal for explanations relating to certain statements made in the present paper.

For several years past I have repeatedly stated that apparently the space within the solar system is traversed by streams of finely divided matter, ejected from the Sun with very great velocity. The reasons for holding this opinion are, of course, based upon observation.

Volcanic eruptions on the Moon's surface were formerly (if not now) a marked feature of lunar life, judging from the topographical appearance of the Moon and the present condition of the parent body.

During an eruption the local atmosphere of dust particles ejected from the Moon, besides retarding the velocity of a passing coronal stream, will at the same time be carried along with the stream; but owing to the Moon's attraction, the material particles are deposited along an arc of a great circle passing through the point of eruption.

As the Moon rotates on its axis the stream of particles will revolve about the local atmosphere as a center or nucleus. The density of the local stream will depend upon the volcanic activity and the momentum of the coronal stream. Volcanic matter sent to the greatest height will in general be carried to the greatest distance from the origin, which may evidently be as great as a whole circumference of the Moon, and, indeed, may be wholly removed from the Moon's direct influence.

In this way even a single large active volcano on the Moon could supply enough material to render conspicuous all the craterlets and other depressions and elevations acting as obstructions to a uniform distribution of particles along the path of a stream. On the Earth's surface such a distribution could not take place owing to the universal atmosphere overlying the whole surface to a depth of many miles. . With us the meteorological elements, especially the prevailing winds, would, for a given case, almost wholly determine the final location of the volcanic dust particles. I have in mind the region of country surrounding Arequipa, to which Professor W. H. PICKERING also calls attention in writing on the same subject in No. 3111 of the *Astrono-*

mische Nachrichten. Here hundreds of square miles of territory are rendered conspicuously brilliant by the enormous quantity of fine volcanic sand deposited in the lower places in the mountains to a depth of many feet, while on the plateaus thousands of mounds literally cover the ground, each mound containing many hundred cubic feet of this volcanic dust. These crescent-shaped pyramidal mounds are constantly undergoing a change of position without any considerable change from a typical form, the disturbing force, a slight air current, is made manifest to the observer in the form of delicate streams of sand, apparently issuing from the top of each pyramid, but in reality driven from the slightly convex side to the slightly concave surface of each mound. Viewed from the top of the west peak of Chachani, more than 18,000 feet above the sea, and from 10,000 to 14,000 feet above the immediate surroundings, the irregularities of distant surface features are rendered strikingly plain to the observer, as the lower places are most brilliant owing to the greater light-refracting power of the volcanic sand there accumulated.

This sand is not uniformly distributed or even symmetrically situated with reference to the probable center of discharge ; in all other respects I was strongly reminded of the lunar features in the neighborhood of conspicuous craters.

A symmetrical distribution of volcanic sand would naturally be expected around a lunar crater, there being no atmosphere, but the great regularity and almost mathematical directness of the paths, and the enormous distances to which the matter (assuming it to be volcanic dust) is carried—hundreds of miles—calls for the action of another force (extraneous) to account for remarkable observed distribution on the Moon's surface. The same theoretical cause which acts to produce the tail of a comet will evidently, in a precisely similar way, produce a miniature representation of a comet on the Moon's surface.

LICK OBSERVATORY, November 13, 1893.